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## 5. SUMMARY

In Egypt, *Sesamia cretica* (Led.) (Lepidoptera: Noctuidae) and *Ostrinia nubilalis* (Hub.) (Lepidoptera: Pyralidae) are economically important insects on maize. The target of the present work aimed to study the changes in the blood picture of the non-diapaused and diapaused last instar larvae of the two studied insects, as well as changes in body weight and histological parameters of the prothoracic cells.

The present work has been cleared during two successive years, 1998/1999 and results obtained are summarized as follows.

1. Five types of haemocytes namely, prohaemocytes, plasmatocytes, coagulocytes, spherule cells, and oocytoids were identified. Two different forms of coagulocytes (Cos) were found: Cos- with granules and Cos-without granules.

2. Counts of haemocyte types during the non-diapaused and diapaused last instar larvae of both *Sesamia cretica* and *Ostrinia nubilalis* were determined.

### A- Prohaemocytes (Prs):

In non-diapaused larvae of *S. cretica*, the diameters of the cell and the nucleus were about  $12.11 \pm 1.07\mu$  and  $10.17 \pm 1.00 \mu$ , respectively. In diapaused larvae the mean diameters were about  $10.05 \pm 1.05\mu$  and  $8.19 \pm 1.25\mu$ , respectively. While in non-diapaused larvae of *O. nubilalis*. The mean diameters of the cell and nucleus were about  $10.41 \pm 1.19\mu$  and  $8.50 \pm 2.01\mu$ , respectively. In diapaused larvae the mean diameters were about  $9.13 \pm 1.06\mu$  and  $7.35 \pm 1.55\mu$ , respectively.

**B- Plasmatocytes (PIs):**

In non-diapaused larvae of *S. cretica* the dimension of the cell and the nucleus were about  $16.48 \pm 1.13\mu \times 11.50 \pm 1.90\mu$  and  $10.26 \pm 2.03\mu \times 7.50 \pm 2.04\mu$ , respectively. In diapaused larvae the dimension of the cell and the nucleus were about  $13.01 \pm 1.63\mu \times 9.51 \pm 1.08\mu$  and  $7.51 \pm 1.13\mu \times 5.50 \pm 1.80\mu$ , respectively. While in non-diapaused larvae of *O. nubilalis* the dimensions of the cell and nucleus were about  $13.00 \pm 1.17\mu \times 9.00 \pm 1.10\mu$  and  $10.35 \pm 1.83\mu \times 7.42 \pm 1.72\mu$ , respectively. In diapaused larvae the dimensions of the cell and the nucleus were about  $10.20 \pm 1.06\mu \times 7.31 \pm 1.39\mu$  and  $7.50 \pm 1.80\mu \times 5.50 \pm 2.41\mu$ , respectively.

**C- Coagulocytes with granules:**

In non-diapaused larvae of *S. cretica* the mean diameters of the cell and the nucleus were about  $12.40 \pm 2.01\mu$  and  $7.31 \pm 1.06\mu$  respectively. In diapaused larvae the mean diameters were about  $8.10 \pm 1.11\mu$  and  $5.26 \pm 1.03\mu$ , respectively. While in non-diapaused larvae of *O. nubilalis* the mean diameters of the cell and the nucleus were about  $13.25 \pm 2.00\mu$  and  $6.51 \pm 1.09\mu$ , respectively. In diapaused larvae the mean diameters were about  $10.13 \pm 2.10\mu$  and  $4.10 \pm 1.15\mu$ , respectively.

**D- Coagulocyte without granules:**

In non-diapaused larvae of *S. cretica* the mean diameters of the cell and the nucleus were about  $13.25 \pm 1.08\mu$  and  $9.16 \pm 1.02\mu$ , respectively. In diapaused larvae the mean diameters were about  $9.16 \pm 1.05\mu$  and  $4.41 \pm 1.19\mu$ , respectively. While in non-diapaused larvae of *O. nubilalis* the mean diameters of the cell and the nucleus were about  $14.29 \pm 1.03\mu$  and  $8.09 \pm 1.06\mu$ , respectively. In diapaused larvae the mean diameters were about  $11.08 \pm 1.68\mu$  and  $5.32 \pm 1.14\mu$ , respectively.

**E- Spherule cells (Scs):**

In non-diapaused larvae of *S. cretica* the mean diameter of the cell and the nucleus were about  $13.09 \pm 1.08\mu$  and  $6.31 \pm 0.08\mu$ , respectively. In diapaused larvae the mean diameters were about  $10.50 \pm 1.09\mu$  and  $4.39 \pm 1.05\mu$ , respectively. While in non-diapaused larvae of *O. nubilalis* the mean diameters of the cell and the nucleus were about  $10.15 \pm 1.80\mu$  and  $6.31 \pm 1.10\mu$ , respectively. In diapaused larvae the mean diameters were about  $8.48 \pm 1.08\mu$  and  $4.39 \pm 1.02\mu$  respectively.

**F- Oenocytoides (Oes):**

In non-diapaused larvae of *S. cretica* the mean diameters of the cell and the nucleus were about  $22.40 \pm 2.08\mu$  and  $7.19 \pm 1.41\mu$ , respectively. In diapaused larvae the mean diameters were about  $17.28 \pm 2.01\mu$  and  $4.16 \pm 0.08\mu$ , respectively. While in non-diapaused larvae of *O. nubilalis* the mean diameters of the cell and the nucleus were about  $18.45 \pm 2.00\mu$  and  $5.36 \pm 1.18\mu$ , respectively. In diapaused larvae the mean diameters were about  $14.18 \pm 2.10\mu$  and  $3.34 \pm 1.09\mu$ , respectively.

3- Variation in body weight, blood volume BV, total haemocyte counts THCs, the absolute haemocyte counts THCs, blood density, and blood weight to body weight in non-diapaused and diapaused last instar larvae of both *Sesamia cretica* and *Ostrinia nubilalis*.

**A. Body weight:**

In non-diapaused larvae of *S. cretica* the body weight reached its maximum value in October during two successive years 1998 and 1999 to  $0.1989 \pm 0.0142$  mg and  $0.1917 \pm 0.0109$  mg, respectively. While, in diapaused larvae the body weight reached its minimum value in April to  $0.1190 \pm 0.0419$  mg and  $0.1143 \pm 0.0125$  mg, respectively. On the other hand in non-diapaused larvae of *O. nubilalis* the body weight reached its maximum

value in November to  $0.1703 \pm 0.0075$  mg and  $0.1691 \pm 0.0100$  mg, respectively. While, in diapaused larvae the body weight reached its minimum value in June to  $0.0531 \pm 0.0072$  mg and  $0.0605 \pm 0.0071$  mg during 1998 and 1999, respectively.

### B. Blood volume (BV):

The DHCs of blood volume reached its maximum in the non-diapaused larvae of *S. cretica* during 98/99 to  $50.59 \pm 8.22\mu\text{l}$  and  $53.61 \pm 7.40 \mu\text{l}$  in October then it decreased in April to  $30.61 \pm 3.18\mu\text{l}$  and  $32.14 \pm 4.50 \mu\text{l}$  in diapaused larvae during 1998 and 1999, respectively. While in non-diapaused larvae of *O. nubilalis* the blood volume reached its maximum in November to  $31.71 \pm 3.55\mu\text{l}$  and  $22.00 \pm 4.29 \mu\text{l}$  during two years. In diapaused larvae the blood volume reached its minimum value in June during tested years to  $13.71 \pm 2.22\mu\text{l}$  and  $9.80 \pm 1.87 \mu\text{l}$ , respectively.

### C. Total Haemocyte counts (THCs):

In non-diapaused larvae of *S. cretica*, the THCs increased to reached its maximum in October during two successive years 1998 and 1999 to  $1561 \pm 316$  and  $1581 \pm 265$  haemocyte/ $\text{mm}^3$ , respectively. In diapaused larvae THCs reached its minimum in April to  $425 \pm 251$  and  $488 \pm 216$  haemocyte/ $\text{mm}^3$ , respectively. While, in non-diapaused larvae of *O. nubilalis* the THCs reached its maximum in November to  $1480 \pm 198$  and  $1525 \pm 264$  haemocyte/ $\text{mm}^3$  during two years. In diapaused larvae the THCs reached its minimum in June during tested years to  $304 \pm 161$  and  $263 \pm 130$  haemocyte/ $\text{mm}^3$ , respectively.

### D. Absolute haemocyte counts (AHCs):

The AHCs reached its maximum in October in non-diapaused larvae of *S. cretica*, during two years to 78971 and 84757 haemocyte/larvae, respectively. While, in diapaused larvae AHCs reached its minimum value in

April during two years to 13009 and 15684 haemocyte/larvae, respectively. On the other hand in non-diapaused larvae of *O. nubilalis*, the AHCs reached its maximum in November to 46931 and 33550 haemocyte/larvae during two years. In diapaused larvae the AHCs reached its minimum in June to 4168 and 2577 haemocyte/larvae, respectively.

4. In non-diapaused and diapaused larvae of *S. cretica*, during two successive years 1998 and 1999 the blood density decreased between January and May from 0.00093 to 0.00082 mg/ml, and then increased its maximum during June and October from 0.00104 to 0.00106 mg/ml. The ratio of blood weight to body weight larvae increased in October to 28.61 % and decreased again in May to 17.65 %. While, in *O. nubilalis* during non-diapaused and diapaused larvae, the blood density ranged between 0.00081mg/ml in Jun to 0.00106 mg/ml in November, and the ratio of blood weight to body weight larvae reached its maximum in November to 27.01 % and decreased again in June to 17.18 %.

5. Variation of DHCs and ADHCs of the haemocyte types during the non-diapaused and diapaused last instar larvae both of *Sesamia cretica* and *Ostrinia nubilalis*.

#### 5.1. Prohaemocytes (Prs):

The percentage of DHCs of Prohaemocytes in non- diapaused and diapaused larvae of *S. cretica*. During the two years 98/99 ranged between  $2.96 \pm 2.31$  % in January to  $8.03 \pm 2.40$ % in August and  $3.01 \pm 1.03$  % in January to  $6.18 \pm 4.49$  % in June respectively. The ADHCs reached its maximum value in August during two successive years to 5890 and 3992 haemocyte/larva in active larvae during October. In diapaused larvae the ADHCs reached its minimum value 884 in February and 630 haemocyte/larva in April, respectively. While in non-diapaused and diapaused larvae

*O. nubilalis* the DHCs ranged between  $2.81 \pm 1.79$  % in May to  $5.40 \pm 2.12$  % in October and  $2.49 \pm 2.17$  % in May to  $4.86 \pm 2.28$  % in August, respectively during two years and the ADHCs reached its maximum value 2210 and 1043 haemocyte/larva during two successive years in November. While, in diapaused larvae the ADHCs reached its minimum value 126 and 77 haemocyte/larva in May during two years.

### 5. 2. Plasmatocytes (PIs):

In non-diapaused and diapaused larvae of *S. cretica*, the percentage of DHCs reached between  $44.04 \pm 2.97$  % in July to  $50.88 \pm 3.40$  % in January and  $48.75 \pm 4.11$  % in July to  $60.14 \pm 3.85$  % in January, respectively. The ADHCs reached its maximum value in October during two successive years 98/99 37132 and 45090 haemocyte/larva, respectively. In diapaused larvae the ADHCs reached its minimum in April to 6116 and 8910 haemocyte/larva, respectively. While in non-diapaused and diapaused larvae of *O. nubilalis* the DHCs ranged between  $52.10 \pm 4.16$  % in March to  $56.01 \pm 5.54$  % in August and  $45.13 \pm 4.23$  % in April to  $52.93 \pm 4.56$  % in November during 98/99, respectively. The ADHCs reached its maximum value 25014 and 17758 haemocyte/larva in November during two tested years 98/99, respectively. While, in diapaused larvae the ADHCs decreased to reached its minimum 2251 and 1237 haemocyte/larva in June in 98/99.

### 5.3. Total coagulocytes (with and without granules):

In the non- diapaused and diapaused larvae of *S. cretica* the percentage of DHCs ranged between  $41.10 \pm 4.97$  % in December to  $44.32 \pm 7.26$  % in May and  $32.74 \pm 2.79$  % in January to  $41.33 \pm 5.21$  % in July in 98/99, respectively. The ADHCs reached its maximum value 32588 in October and 30953 haemocyte/larva in September during two years. While, in diapaused larvae the ADHCs decreased to reached its minimum value 5749 and 5506 haemocyte/larva in April in 98/99. In the non-diapaused and diapaused larvae



of *O. nubilalis* the DHCs ranged between  $36.45 \pm 3.52$  % in July to  $40.39 \pm 3.76$  % in February and  $39.00 \pm 3.68$  % in October to  $48.14 \pm 3.40$  % in March, respectively. The ADHCs reached its maximum value in November during two years to 17895 and 13091 haemocyte/larva, in active larvae. While, in diapaused larvae the ADHCs decreased to reached its minimum value to 1550 and 1135 haemocyte/larva in June during two successive years.

### 5.3.1. Coagulocytes with granules:

In the non- diapaused and diapaused larvae of *S. cretica* the percentage of DHCs ranged between  $10.41 \pm 3.40$  % in October to  $21.46 \pm 2.70$  % in August and  $11.19 \pm 2.87$  % in October to  $20.39 \pm 1.52$  % in August during two tested years 98/99, respectively. The ADHCs in active larvae reached its maximum value in August during two years to 15689 and 14488 haemocyte/larva respectively. In diapaused larvae the ADHCs decreased to reached its minimum value in April during two years to 2379 and 2098 haemocyte/larva respectively. While, in the non-diapaused and diapaused larvae of *O. nubilalis* the DHCs of Cos with granules ranged between  $15.01 \pm 3.78$  % in June to  $19.36 \pm 4.22$  % in February and  $18.23 \pm 2.36$  % in May to  $22.31 \pm 4.62$  % in August, respectively. during two years. In active larvae the ADHCs reached its maximum value in November to 7988 and 6381 haemocyte/larva, during 98/99. While, in diapaused larvae the ADHCs decreased to reached its minimum value in June to 626 and 568 haemocyte/larva during two successive years.

### 5.3.2. Coagulocyte without granules:

In 1998 & 1999, the DHCs of coagulocyte without granules during non-diapaused and diapaused larvae of *S. cretica* ranged between  $20.54 \pm 4.88$  % in August to  $29.59 \pm 3.91$  % in October and  $20.02 \pm 2.42$  % in August to  $25.09 \pm 2.19$  % in October during two years 98/99, respectively.

In non-diapaused larvae the ADHCs reached its maximum value to 23367 and 21265 haemocyte/larva in October respectively during the tested years 1998/1999. While, in diapaused larvae the ADHCs reached its minimum value in April during two years to 3370 and 3408 haemocyte/larva respectively. While, in the non-diapaused and diapaused larvae of *O. nubilalis* the DHCs of Cos without granules ranged between  $19.05 \pm 4.22$  % in July to  $23.82 \pm 4.97$  % in January and  $18.00 \pm 4.77$  % in August to  $28.33 \pm 2.92$  % in March during two years respectively. In active larvae the ADHCs increased to reached its maximum value in November to 9907 and 6710 haemocyte/larva, during 98/99. While, in diapaused larvae the ADHCs decreased to reached its minimum value in June to 924 and 567 haemocyte/larva during two successive years.

#### 5.4. Spherule cells (Scs):

In the non-diapaused and diapaused larvae of *S. cretica* the DHCs of spherule cells ranged between  $1.01 \pm 0.28$  % in May to  $4.00 \pm 1.38$  % in December and  $1.50 \pm 1.52$  % in January to  $3.06 \pm 0.92$  % in June, respectively. In active larvae the ADHCs reached its maximum value in October during two years to 2055 and 1754 haemocyte/larva, In diapaused larvae, the ADHCs reached its minimum value April during tested to 214 and 373 haemocyte/larva. While in the non-diapaused and diapaused larvae of *O. nubilalis* the DHCs of spherule cells ranged between  $2.04 \pm 1.48$  % in August to  $2.82 \pm 1.14$  % in March and  $1.09 \pm 0.58$  % in January to  $3.58 \pm 2.19$  % August during two years. In active larvae the ADHCs reached its maximum value in October to 1123 and 945 haemocyte/larva, while in diapaused larvae the ADHCs reached its minimum value in June to 108 and 77 haemocyte/larva.

### 5.5. *Oenocytoides* (Oes):

In the non-diapaused and diapaused larval of *S. cretica* the DHCs ranged between  $1.33 \pm 0.79$  % in April to  $3.39 \pm 0.70$  % in August and  $1.59 \pm 0.98$  % in May to  $3.74 \pm 2.30$  % in October. In active larvae the ADHCs reached its maximum value during two years to 2598 and 3170 haemocyte/larva in October. While, in diapaused larvae, ADHCs reached its minimum value in April to 173 and 263 haemocyte/larva, while in the non-diapaused and diapaused larvae of *O. nubilalis* DHCs ranged between  $1.74 \pm 1.80$  % in July to  $3.18 \pm 1.50$  % in January and  $1.29 \pm 1.12$  % in December to  $2.68 \pm 1.50$  % in July, respectively. The ADHCs in active larvae reached its maximum value in November to 873 and 627 haemocyte/larva during two successive years. While, in diapaused larvae, ADHCs reached its minimum value in June during two years, to 127 and 47 haemocyte/larva,

6. The Measurements of Prothoracic glands during the non-diapaused and diapaused last instar larvae both of *Sesamia cretica* and *Ostrinia nubilalis*.

In the non-diapaused larvae of *S. cretica* the mean dimension of the cell and the nucleus were about  $(56.36 \pm 6.45\mu \times 41.28 \pm 7.84\mu)$  &  $(48.19 \pm 4.13\mu \times 25.08 \pm 3.22\mu)$ . While, in diapaused larvae, dimension of the cell and the nucleus were about  $(43.19 \pm 5.25 \mu \times 26.41 \pm 4.52\mu)$  &  $(35.43 \pm 6.90\mu \times 19.29 \pm 2.43\mu)$ .

While, in the non-diapaused larvae of *O. nubilalis* the dimension of the cell and the nucleus were about  $(55.51 \pm 6.31\mu \times 35.27 \pm 3.99\mu)$  &  $(38.30 \pm 3.70\mu \times 18.41 \pm 2.45\mu)$ . While, in diapaused larvae, dimension of the cell and the nucleus were about  $(42.50 \pm 4.23\mu \times 27.22 \pm 2.87 \mu)$  &  $(29.39 \pm 4.62 \mu \times 12.47 \pm 1.73 \mu)$  respectively.